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ABSTRACT

This paper reports on applications of quality tools, developed for industrial settings, to educational management and instruction at three technical education centers. The necessary data were collected by the centers as they prepared for registration to the International Standards Organization Quality Assurance Standards. Application was made of the following tools: flow charts, histograms, control charts, parato charts, and check sheets. In some cases, application of these tools identified quality problems and in other cases led to more advanced analysis. In all cases, the tools provided the institutions with a better understanding of how they might improve educational quality. Examples of each of the methodologies are provided. The importance of these tools to the individuals doing the work is stressed, as well as the role of institutional researchers in persuading educators to use these tools. Includes seven references. (DB)

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Application of Tools of Quality to Education

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Running head: QUALITY TOOLS

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This paper was presented at the Thirty-First Annual Forum of the Association for Institutional Research held at The Westin St. Francis, San Francisco, California, May 26-29, 1991. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum Papers.

Jean Endo
Chair and Editor
Forum Publications Editorial
Advisory Committee

Abstract

The purpose of this paper is to report on applications of quality tools in three technical centers. The data were collected within the three centers as they prepared for registration to the International Standards Organization (ISO) Quality Assurance Standards. Application were made of Flow Charts, Histograms, Control Charts ,Parato Charts, and Check Sheets. In some cases, these tools identified quality problems and in other cases they led to more advanced analysis. In all cases they provided the institutions with a better understanding of how they might improve their quality. Institutional researchers need to learn how to persuade faculty members and administrators to use simple quality tools to improve quality.

Application of Tools of Quality to Education

Introduction and Perspective

Tools of quality have been used in non-educational institutions around the world for the past fifty years to help people solve quality problems. Since many institutional researchers are not familiar with quality standards used in non-educational institutions, the following rather lengthy perspective on quality comes from page 1 of the standard used by these non-educational institutions (ANSI/ASQC A3-1987).

"Almost from the beginning of recorded history there is evidence that people have been interested in achieving and maintaining a reputation for producing or receiving products or services that have satisfied certain quality requirements. An individual craftsman might check his own work; a craft guild or official might inspect all items or certify the reputation of the craftsman; an inspection department might be set up to examine all product; and so forth. In recent times, the speed of mass production has brought about emphasis on the need to prevent problem occurrence, rather than simply culling unsatisfactory items after the fact; the evaluation of materials, tools, and complex assemblies now has become more complicated; the economic allocation of resources and environmental considerations have become important factors; and the consumer has become more aware of what is needed and possible. In essence, the rapid development of modern industrial societies has accelerated the need for broad systems that can treat all of the elements that affect quality. Different industries, and companies within these industries, have faced this situation at their own pace, and often, in

order to highlight some change in practice, have adopted terminology that suited a perceived need.

"The advent of mandatory standards accelerated this trend further, but the variety in terminology used by the several regulatory agencies and government departments has added to the confusion. Essentially, however, the same basic concept prevails. Each wants to be sure that the quality of the product or service involved satisfies the requirements. To some, this means quality must be controlled; hence quality control. To some, the product or service must be delivered in condition to satisfy requirements of purchaser or agency is only responsible for evaluating what has been delivered. To some, the method of manufacture and assessment must be shown to meet prescribed conditions; hence the evaluation of a quality plan and a quality system to implement it.

"In technical usuage, the word quality relates the features and characteristics of a product or service to the ability of that product or service to satisfy stated or implied needs, and this is the sense in which it is used in this standard. In a broad descriptive usage, the word is often considered in a non-quantitative sense as a degree of excellence whereby products or services may be ranked against others on a relative basis for a selected subset of features and characteristics, which is referred to as relative quality in this standard."

The approach used in this paper was consistent with international quality assurance standards which served as the model for quality improvement. Definitions of quality and all statistical terms followed

international standards and any necessary adaptations were consistent with the intent of the standards.

Purpose

The purpose of this study was to apply tools of quality to management and instruction in technical centers.

Literature Review

Only recently have educators become interested in modern applications of quality techniques to problems in education. If bridges are to be built to the twenty-first century, then a brief overview of twentieth century literature on quality in non-educational institutions is necessary in order to benefit from their quality improvement experience.

The quantitative development of quality control began while Walter A. Shewhart was working at Bell Labs and Western Electric in the 1920's. Following a series of technical papers he published his work (Shewhart, 1931) and defined the concept of chance (common) causes and assignable special causes. He developed the first tool of quality, the control chart, to identify common and special causes based on variability patterns in data from process monitoring. Courses in quality control were taught during the second world war, but his ideas were not widely accepted in the United States despite the fact that several industries were achieving good results from quality control. It was not until W. E. Demming introduced quality control conecpts to Japanese managers and engineers in 1950 that quality sciences were applied to industry in a

major way. The practical applications relied heavily on simple graphic tools which were used by the workers to monitor and to adjust their own work and to align it with production specifications (Ryan, 1989, p. 26).

In Japan many of these tools were developed by Ishikawa who brought their utilization to production lines (Ishikawa, 1976). A very basic and practical discussion has been prepared on seven quality tools (Burr, 1990). Applications of the tools have been made to service industries, public sector government agencies, and the military. A few applications of these tools have been made to education, but interest in them as a part of total quality management seems to be growing.

Fox Valley Technical College in Appleton Wisconsin has been working on quality applications to education since 1985 (Spanbauer, 1989). The tools used at Fox Valley include the flow chart, cause and effect diagram, Pareto diagram, control chart, frequency chart, and check sheets. A special use of control charts in technical education in Florida was reported at the European Association for Institutional Research Forum (Johnson, September, 1990). The application established control limits for the difference between number of hours required to complete course work and the number of hours actually taken by students who completed the course.

Data Sources

The data for this study came from three technical centers that have been using the techniques of quality in instruction and management within their institutions. All three institution are working toward registration to international quality standards.

This proposed paper used quality tools developed for industrial settings to collect data and adapted them to technical education institutions to improve quality.

Approach

The approach used in this study was to provide three training centers with material on the quality tools and have them select the tools which seemed most appropriate for the process they wished to control. This was done for several reasons, the most important being that the people who are closest to the process can improve it most easily and will be more motivated to do so if the make the decisions regarding the measurement techniques selected. Once the data were collected at the operating level, then more sophisticated statistical techniques could be brought to bare on the analysis of the data. The tools used at the three centers included, Flow Charts, Histograms, Check Sheets, and Parato Charts. The following sections describe the specific application with an introduction to the technique taken from Quality Progess (Burr, 1990).

Flow Chart

Flow charts follow simple rules designed to increase discussion among all people involved in the process. The most improtant rule is that the people who actually do the process make the chart and all members of the group must participate. In addition, all data must be visable to everyone at all times. Finally, they must be enought time alloted to give everyone a chance to ask all the questions they have.

Two processes were studied at different Centers using flow charts. The first tracked the process of students entering for the first time.

The second traced the steps involved in troubleshooting student services management of date.

The flow charting of the student entering process was selected as a quality improvement process because it effected all students, consumed staff time and resources, and provided the staff with a picture of what they were doing in relation to others. The process involved two steps. The first step was to have each staff members who was involved in a specific process attend a half-day workshop on how to chart the flow of a 6process. The next step was to have each staff member chart his or her own part of the student entrance process. Concurrently a graduate assistant who had been trained in quality improvement charted the entire process from the point of view of the entering student. The supervisor and the Assistant Director for Instruction reviewed each flow chart for each part of the process in relation to the entire process. This provided the opportunity for the supervisor to view the whole process and to adjust any missing connections among the parts.

(Insert Figure 1 here)

The second example of flow charting comes from the more technical process of supporting requests for information by student services. The major use of the flow chart in this case was to identify the nature of the problem through discussions and then to match the solution to the analysis of the problem. This systematic approach was under the control of the people who were closes to the problem and provided a way for them to check the quality improvement at each step of the improvement process.

(Insert Figure 2 here)

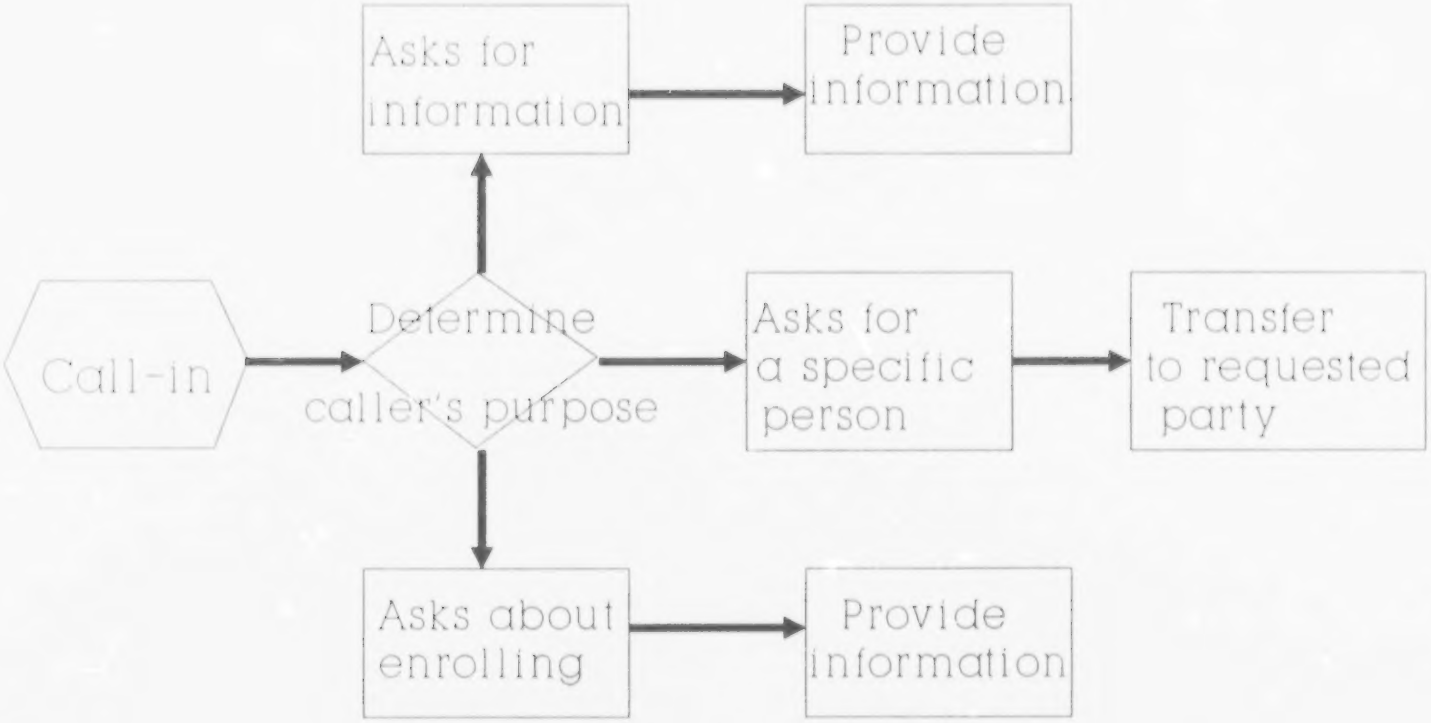

Figure 1 - Registration Flowchart

TO ACCOMODATE CHANGES REQUIRED IN THE MANAGEMENT OF STUDENT SERVICES, A STAFF MEMBER IS SHARED JOINTLY TO ACT AS A TROUBLESHOOTER AND PROVIDE SHARED INFORMATION TO BOTH DEPARTMENTS.

THIS STAFF MEMBER IS SCHEDULED TO WORK IN STUDENT SERVICES IN THE AFTERNOON EACH DAY. THE PROCESS OF INFORMATION FLOW AND TROUBLESHOOTING IS OUTLINED BELOW.

A VENTURE IN TROUBLESHOOTING: A COOPERATIVE AGREEMENT BETWEEN STUDENT SERVICES & DATA PROCESSING

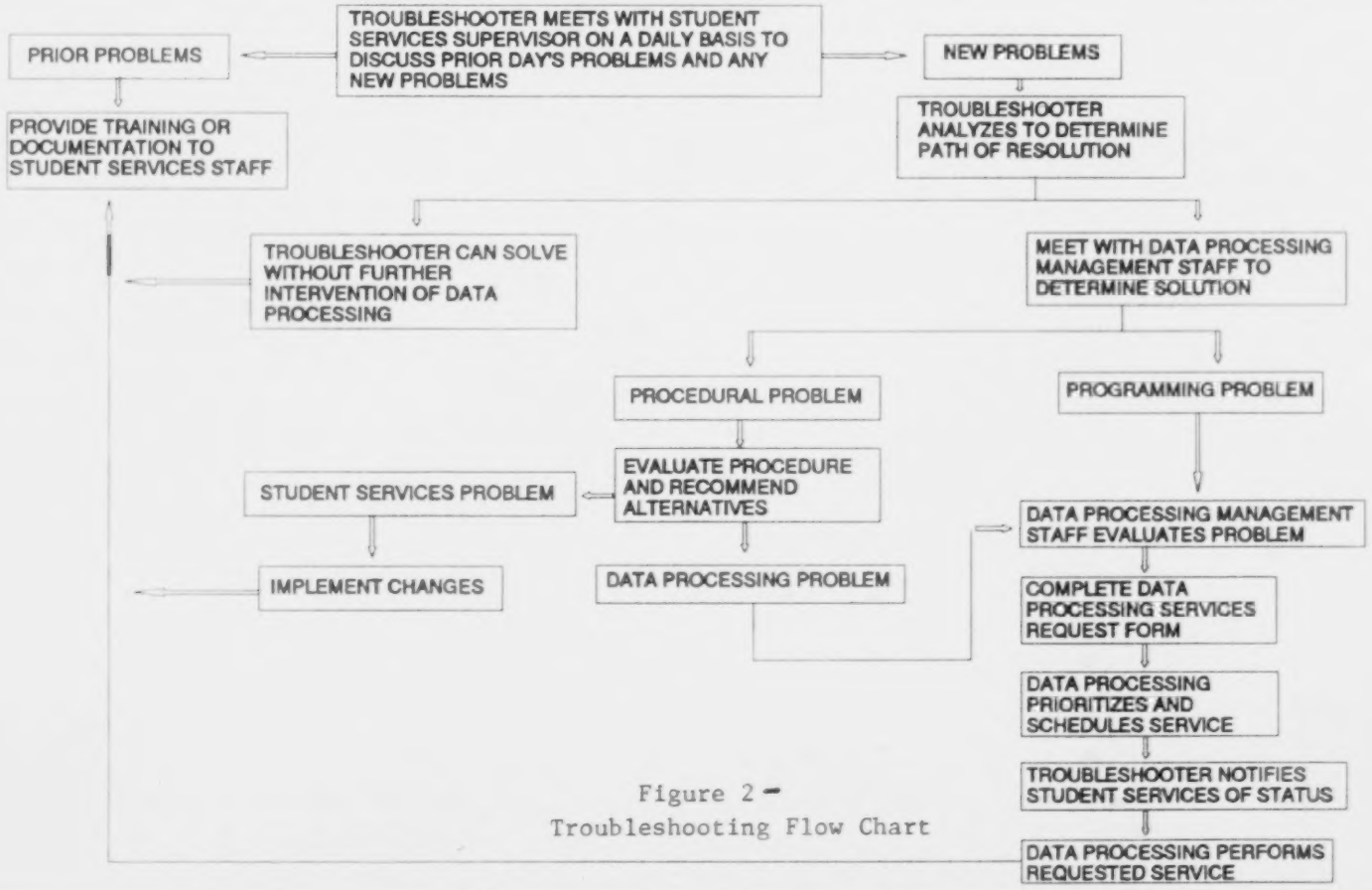
TROUBLESHOOTER MEETS WITH STUDENT SERVICES SUPERVISOR ON A DAILY BASIS TO DISCUSS PRIOR DAY'S PROBLEMS AND ANY NEW PROBLEMS
PRIOR PROBLEMS
NEW PROBLEMS
PROVIDE TRAINING OR DOCUMENTATION TO STUDENT SERVICES STAFF
TROUBLESHOOTER ANALYZES TO DETERMINE PATH OF RESOLUTION
TROUBLESHOOTER CAN SOLVE WITHOUT FURTHER INTERVENTION OF DATA PROCESSING
MEET WITH DATA PROCESSING MANAGEMENT STAFF TO DETERMINE SOLUTION
PROCEDURAL PROBLEM
PROGRAMMING PROBLEM
STUDENT SERVICES PROBLEM
EVALUATE PROCEDURE AND RECOMMEND ALTERNATIVES
DATA PROCESSING MANAGEMENT STAFF EVALUATES PROBLEM
IMPLEMENT CHANGES
DATA PROCESSING PROBLEM
COMPLETE DATA PROCESSING SERVICES REQUEST FORM
DATA PROCESSING PRIORITIZES AND SCHEDULES SERVICE
TROUBLESHOOTER NOTIFIES STUDENT SERVICES OF STATUS
DATA PROCESSING PERFORMS REQUESTED SERVICE

Figure 2 -
Troubleshooting Flow Chart

Histograms

The Histogram is a common tool introduced in all basic statistics courses. What is not so common is the use made of these charts to improve quality. Certain principles guide these applications. Values in a data set show variation which displays a pattern. Often the patterns are difficult to see in tables of data and the histrogram helps to display the patterns. Understanding variation is central to statistical quality control.

The Histogram was developed to summarize the drop-out rate of students in various courses. The original data were collected on a time line which tracked a cohort group through a given term. When these two documents were used together, the course instructors were able to see how many students were dropping out and when the were doing so. Collection of data in this form is a vital part of any quality improvement process. It is simple, can be directly related to a cost factor, and provides a objective basis for seeking solutions.

(See Figures 3 and 4)

Check Sheets

Check Sheets are the basic data collection instrument used in quality improvement because it is simple and can be used by workers on their jobs. The formulation of good questions is critical. Many hours go into the data collection and the effort must show useful results if the data colection is to be continued. The experience of the typical institutional researcher will serve well here and the importance of clean data with meaningful analysis will not be lost on them.

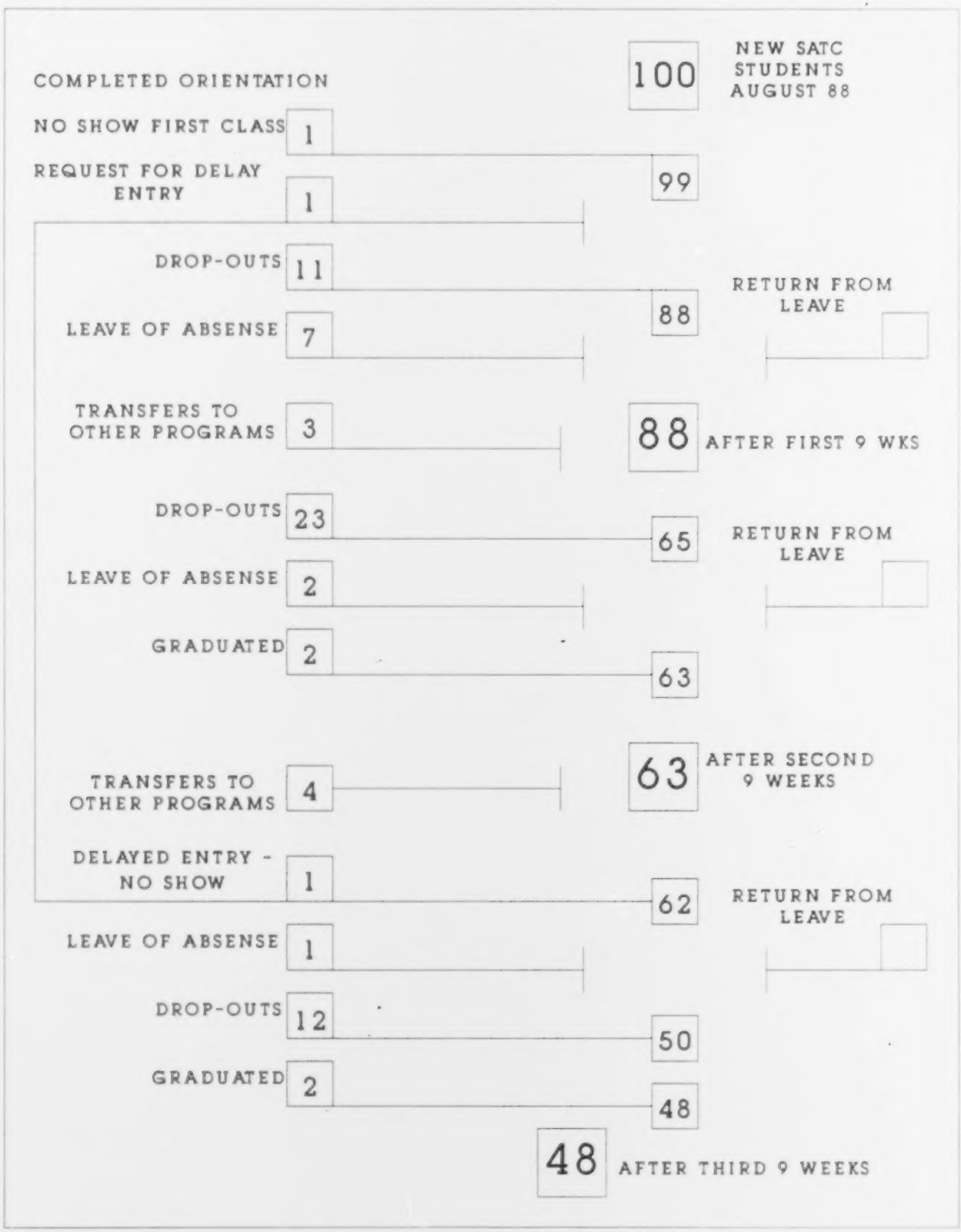

Figure 3 - Histogram Data

Drop-Out Statistics

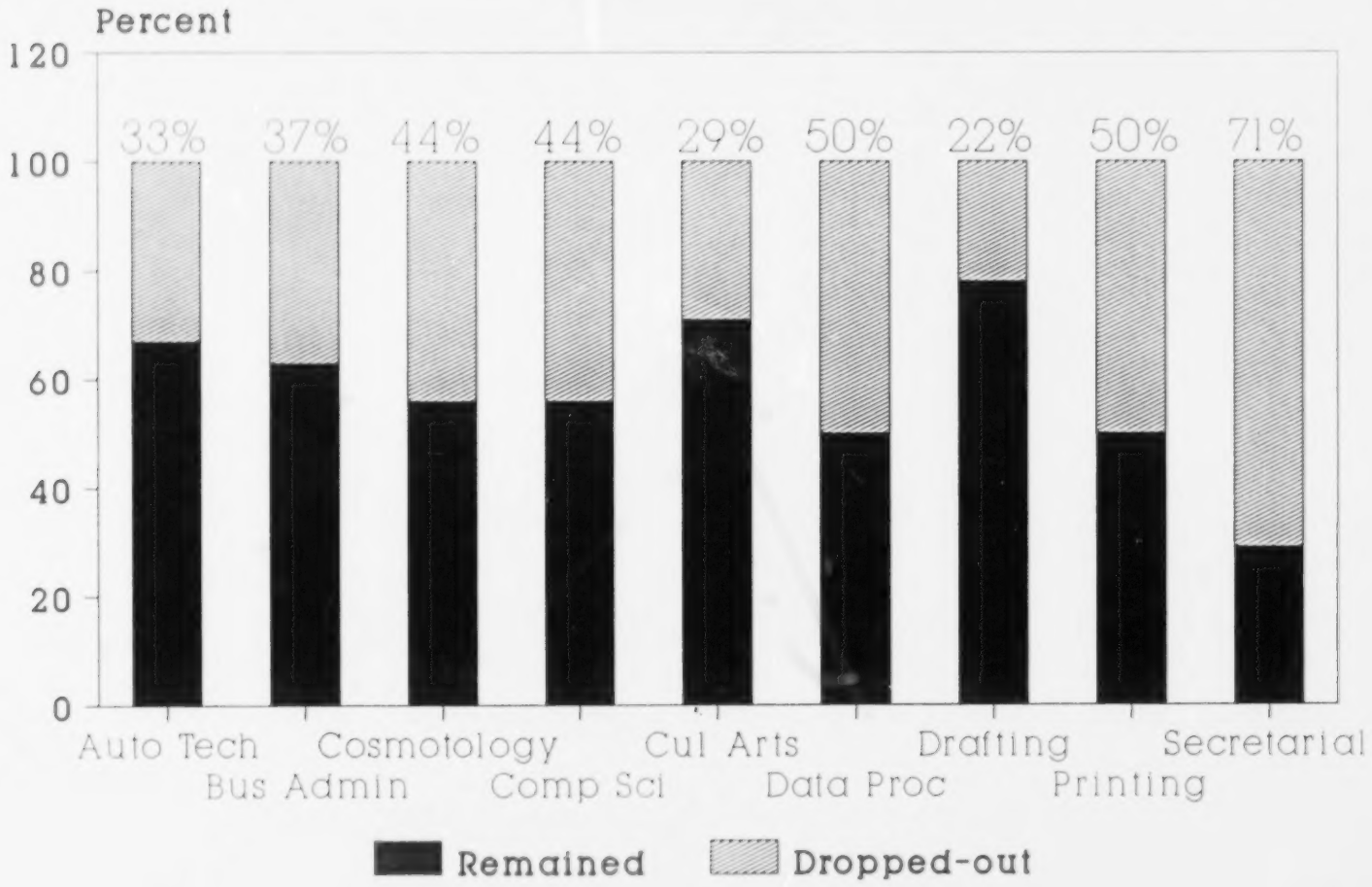

Figure - 4 Dropout Histogram

The Check Sheet is the most basic quality tool in industrial applications and has a long history of producing quality improvements. The operator, in this case one person in the registration office, recorded over fifty transactions which occurred during a week. The type of transaction and the time of day were recorded. The flow of three process was observed in relation to the time of day each occurred. This not only provided the operator with a picture of the work flow, but also provided a basis for discussion with other members of a quality improvement team with objective information about the process.

(Insert Figure 5 here)

Parato Charts

The basic logic of the Parato Chart is that most effects come from relatively few causes. If those few causes can be identified, then quality improvement will proceed more rapidly. The basic model differs from our understanding of a normal distribution or normal curve. The Parato Model suggest that a few people cause most of the problems, that most of the student credit hours are generated in a few large courses, and that on most topics a few people have most of the knowledge.

This quality tool was used to provide a focus and forward direction to a brainstroming session held at a management retreat. During the brainstorming session itself, one hundred and twenty two "Dreams, Visions, and Ideas" were presented and recorded without comment. Participants were then asked to vote for the items which they were willing to support. The votes were tallied and arranged in descending order. The next step was to work on the item which received the most

REGISTRATION DAILY LOG

Week of MARCH 25

REGISTRATIONS	INFORMATION CALLS	REQUEST CALLS
8 A.M. - 10 A.M. ++++ ///	++++	++++ //
10 A.M. - 12 P.M. ///	//	
12 P.M. - 2 P.M. ++++ // ///	// / ++++ // ++++	/
2 P.M. - 4 P.M. /	/ /	
4 P.M. - 7 P.M. ///	//	

Figure 5 - Registration Checksheet

votes and then see how the resulting quality improvement would influence the remaining problems.

(Insert Figure 6 here)

Results and Conclusions

All three centers have reported progress through quality improvement. The specific tools of quality they have used have helped them overcome many of the obstacles which prevent teachers and administrators from colecting and analysing data in the traditional wavs.

Implications for Institutional Researchers

The applications of tqtal quality management to the public sector are growing rapidly. The specific techniques and tools should be of concern to institutional researchers who many be called upon to assist others in their use. The tools, at first glance, seem simple enough and for the experienced researcher they are. The important point is that the tools must be used by the people who are doing the work. This means faculty members is various disciplines, many of who pride themselves in not being able to balance a checkbook, have to be persuaded to collect data on their own performance. Clerks in many offices must be convinced to use data collection and analysis tools which will save them time and not add to their current tasks. The "people problems" are not much different in non-educational settings. Institutional researchers can profit from their experience in persuading others to use the tools of aquality.

Votes for Quality Improvement Activities

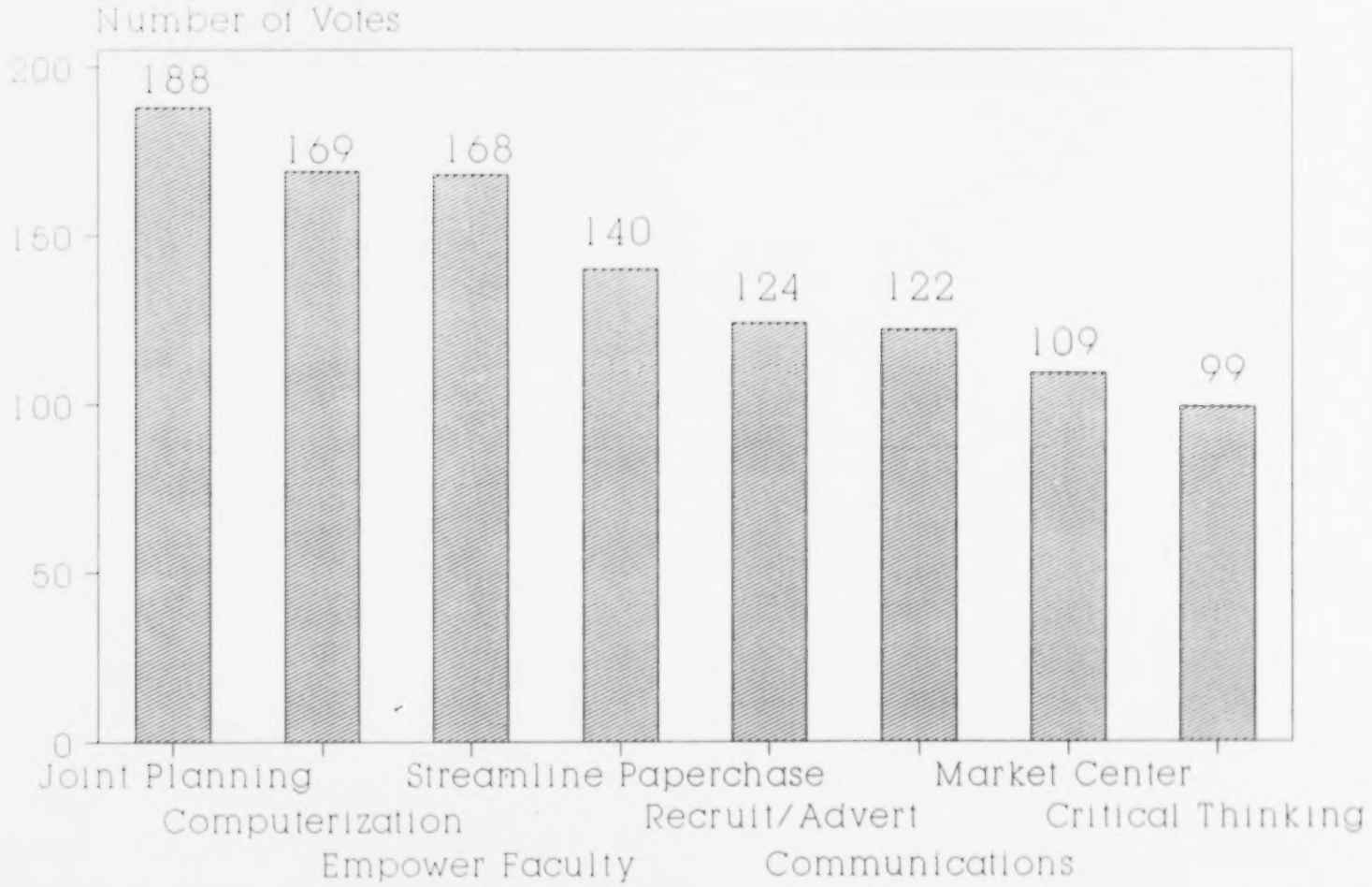

Figure 6 - Quality Improvement Parato Chart

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